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THE ORGANIZATION OF THE METEOROLOGICAL SERVICE IN SOME OF THE PRINCIPAL COUNTRIES OF EUROPE.

I. FRANCE.

THE following article has been almost entirely compiled, in a very condensed form, from one of a series of elaborate reports made, about two years ago, to the Prussian Ministry of Education by Dr. Gustav Hellmann, of the Statistical Office, Berlin. Some changes have recently taken place in the various services, especially in France; we have, however, taken cognizance of these as far as they are known to us.

SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE.

We commence this memoir with a brief notice of one of the oldest French meteorological organizations. In 1849 MM. Bérigny, C. Martins and Haeghens joined in the publication of a work entitled the *Annuaire Météorologique de France*. Four volumes (1849-52), containing observations and papers were published, but, as the cost was too much for private means, they established the Meteorological Society in December, 1852, of which the number of members is now about 300. A volume of the *Annuaire de la Société Météorologique de France* has been published yearly from 1852, and from 1868-76 the *Nouvelles Météorologiques*, containing detailed observations at about 60 stations up to the year 1872, and subsequently monthly *résumés*. From the year 1880 the *Annuaire* has been re-arranged, and is divided into three sections:—A *résumé* of the proceedings of the meetings of the society, (2) papers communicated by the members, and (3) monthly *résumés* of observations made at stations both in France and abroad. In May, 1877, the *Quinzaine Météorologique* was begun under the auspices of the society, and contained original observations from about 20 stations, a chronicle of the weather, and plates of curves; but the publication was given up after a very short time.

The Montsouris Observatory (Paris.)

This was established in 1871, through the influence of some of the leading scientific men, *e.g.*, A. Dumas and C. Sainte-Claire Deville. In 1872 it was affiliated to the National (Astronomical) Observatory, the meteorological work of the latter being transferred to Montsouris. But on Le Verrier's re-appointment to the Paris Observatory in February, 1873, Montsouris again became separated. This observatory is on the extreme south side of Paris, and the building was originally an oriental coffee-house attached to the Universal Exhibition, 1867. The building is not well adapted for the reception of instruments, but the site is all that can be desired.

The work of the Observatory is divided into three distinct departments :—(*a*) Meteorology, including terrestrial magnetism and the physics of the atmosphere; (*b*) the chemistry of the atmosphere, and agricultural meteorology; (*c*) microscopic investigation of the atmosphere. The two last sections have been added recently.

In the first section, eye observations are made every three hours from 6 a.m. till midnight, and self-recording instruments work continuously. The standard barometer, on M. Renou's pattern, has a cylindrical cistern, the area of which is 100 times that of the tube. The self-recording barometer is a mechanical one by Salleron.* The thermometers, as generally in France, are exposed in a screen which differs considerably from those in use in England, being of sheet-iron, with a double roof, having a small space between, and with metal side shields. The thermometers are placed about 7 feet above the ground, and are not protected from terrestrial radiation.† Experiments have shown, however, that the mean results differ but slightly from those obtained by a Kew screen, or by a sling thermometer. The Observatory also possesses a mechanical meteorograph, constructed by Rédier, and described in the *Annuaire* for 1876. An index traces a white curve on blackened cylinders, the black surface being afterwards fixed by immersion in a solution of shellac and alcohol. The air-temperature at an altitude of about 67 feet is observed by means of an electrical thermometer by Becquerel. The underground temperature is observed by thermometers placed in a shaft of powdered coke, in order to render the readings comparable. Three rain gauges are in use, one being self-recording; the rims are about 6 feet above the ground. The direction and velocity of the wind are recorded, at an altitude of 66 feet, by means of Hervé Mangon's anemograph, which gives the direction under eight principal points, every ten minutes, and the veolcity for every half-kilometre (=0·3 mile) traversed Wind pressure is also recorded by a Ventouri-Bourbon aspiration tube. The motions of cirrus clouds are observed by a mirror fixed horizontally. Magnetic instruments were erected in the winter of 1877–8.

Publications: The monthly Bulletin (of which the publication seems

* See *Met. Mag.* vol. xiii. p. 65. † See *Met. Mag.* vol. xiii. p. 49.

to be suspended) contained the eye-observations and a selection from the indications of the self-recording instruments. The *Annuaire Météorologique*, which is published regularly each year, contains *résumés* of observations and various useful articles relating to agriculture and hygiene; also a magnetic chart of France revised from observations at various places by MM. Marié-Davy (the Director) and Descroix. The funds at the disposal of this observatory amount to £2,500 a year, of which the town of Paris contributes £500, and the State the rest. An additional sum of £800 was voted in the year 1878 for the completion of the instruments. The director resides in the observatory.

The Central Meteorological Office.

This office was established in the spring of 1878, and is located in the Rue de Grenelle, Paris. On the decease of the renowned Le Verrier (in September, 1877), the meteorological service of the National Observatory was separated from the astronomical work, to the advantage of both sciences; the former being placed under M. E. Mascart, formerly Professor of Physics at the *Collége de France*. The meteorological work of the Observatory, *before its transfer*, may be subdivided into two general heads: (1) the study of the general movements of the atmosphere, and (2) the general physics of the various basins in France, and the organization of the labours of the Departmental Commissions engaged in this work. Until the year 1854 the Paris Observatory was limited, with regard to meteorology, to its own observations, and (excepting the telegraphic weather service,) until the year 1864, there was scarcely any governmental organization in France worth mentioning. There was no lack of observing stations, but there was no connection between them, and no superintending central station. In 1864, Le Verrier, with the approval of the Minister of Public Instruction, invited the Councils-general to establish observing stations at the Normal Schools. This proposal was favourably received, and the discussion of the observations was undertaken by the Observatory. A further development soon followed by the establishment of Departmental Commissions, composed chiefly of professional men, whose duty it was to collect all observations made in their departments, and to forward them to the Observatory, and later (in 1873) to undertake the first inspection of the stations, and to superintend the publication of the observations made in their respective departments. In 1865, the special study of thunderstorms was begun, and additional observers were found among the clergymen, medical men, teachers and others. No instruments were required for this service; the observations recorded were: (1) time of commencement and end of storm, (2) direction of its appearance, (3) direction of its disappearance, (4) direction and rapidity of clouds, (5) direction and force of wind, (6) intensity of lightning, (7) intensity of thunder, (8) intensity and duration of rain, (9), intensity and duration of hail

(10) damage done, (11) state of crops before and after storm, (12) money value of losses. The results of these observations were published in the *Atlas Météorologique de la France*, 1865-76. This atlas also contains some valuable discussions, including contributions by scientific men abroad. Our space will not permit us to give a list of these articles; we can only state here that among the subjects will be found—(1) Agricultural and Forest meteorology (Becquerel and Mathieu); (2) Rainfall of the W. basin of the Mediterranean, of Algeria, and of Central France, 1765–1870 (Raulin); (3) General movements of the atmosphere (Hébert and Peslin); (4) Meteorological Charts (Brault); (5) Meteorology of Portugal (Brito-Capello). France, which is specially affected by thunderstorms, was foremost in the systematic study of these observations; other countries, *e.g.*, Belgium, Norway, and Sweden, subsequently instituted similar observations. The publication of observations made at the stations of the second order has been much neglected by the Observatory. Out of 89 Departmental Commissions, only about four have published their observations partially *in extenso*, *e.g.*, Lyons, Hérault, Pyrénées-Orientales, and Vaucluse. We have, however, recently received from the Central Office two large quarto vols. of *Annales* for the year 1878, containing detailed observations relating especially to thunderstorms and rainfall, and also important discussions, and several other volumes are in course of publication for the years 1878-9. In 1877 the number of stations of the second order was 67, most of which were provided with standard instruments. The times of observation differed from three to even eight observations daily. Unfortunately, however, many stations discontinued the observations during *fêtes*, which are not few in France! But a recent decree has made observations compulsory at the Normal Schools.

To Le Verrier is also due the honour of first using the telegraph in Europe (in 1855) for the dissemination of weather information for the benefit of shipping; the idea, however, was first mooted by Romme, in France, in 1793, by means of the optical telegraph, and subsequently by Kreil in Austria in 1842, and by Redfield in the "*American Journal of Science and Art*" in 1847, and it will also be remembered that telegrams from all parts of the United Kingdom were posted up at the International Exhibition of 1851. The "Balaklava Storm" of 14th November, 1854—which did so much damage to the allied fleets—had drawn attention to the possibility of giving useful storm warnings. It was only since 1860 that Le Verrier's sphere of action was extended to foreign countries. It should be mentioned, however, that Le Verrier telegraphed *facts*. In a letter dated 4th April, 1860, he wrote to the Astronomer Royal:—*Signaler un ouragan dès qu'il apparaîtra "en un point de "l'Europe, le suivre dans sa marche au moyen du télégraphe, et informer "en temps utile les côtes qu'il pourra visiter, tel devra être le dernier "résultat de l'organisation que nous poursuivons.*" Admiral FitzRoy

was the first to institute *warnings* in the true sense of the word (February, 1861), by telegraphing notice of *impending* storms to our own coasts, and indicating their direction and intensity by "drum" and "cone" signals. This—but one out of various public services—made his honoured name a household word throughout the United Kingdom, and to this work, humanly speaking, he sacrificed his life. On and after August 12, 1863, Le Verrier not only telegraphed facts, but also forecasts of the impending weather. One of Le Verrier's last acts was the extension of the agricultural service all over France. This service was established by a decree of 13th February, 1873, and the first notices were dispatched on the 12th August, 1876. On the 1st May, 1878, the service comprised 1587 stations. Notices which are useful to the agriculturist are different from those which concern the navigator. The former is interested in the occurrence of thunderstorms, rain and hail, while generally the wind is of little consequence. To foretell rain—which is often a local phenomenon—is one of the most difficult problems of meteorological science. The agricultural notices contained the barometer readings of a few stations, and the general state of the weather.

The labours of Le Verrier in the domain of Ocean Meteorology must not be left unmentioned. In 1861 he proposed the sub-divison of this work among different nations. In this scheme England was banished to the Indian Ocean, France taking the Atlantic. The plan did not meet with general approval; it resulted in so much, however, that it drew general attention to the subject, and a series of synoptic charts for the Atlantic Ocean, N. of 40° N. lat., embracing nine months in the year 1864 and the whole of 1865, were published in the "*Atlas des mouvements généraux de l'atmosphère.*" Similar charts have been begun by Meldrum for the Indian Ocean; and recently Capt. Hoffmeyer, of Copenhagen, has published a more elaborate set of charts for the North Atlantic, for September, 1873, to November, 1876. We should also mention Capt. Toynbee's very careful discussions of the weather in the Atlantic, published by the London Meteorological Office.

As before stated, the meteorological work of the Observatory has been transferred to the Central Meteorological Office. This office is under the Ministry of Public Instruction, and is superintended by a council. The decree establishing the office lays down the following general lines of action, which resemble those hitherto followed by the Observatory:—(1) The study of the general movements of the atmosphere; (2) notices to ports and to agriculturists; (3), researches in meteorology and climatology, so that generally speaking there is no change, but considerable improvement in the system. We have no exact information as to the funds which were at the disposal of the meteorological branch of the observatory, but they could not have been less than £2,500 a year. The expense of publication was mostly borne by the *Association Scientifique*. Telegraphy

was free, except the agricultural notices, for which a charge of 40 francs (33s.) a year was made to each station receiving the report.

ALGERIA.

This African colony has also a meteorological organization, thanks to the efforts of the late M. C. Sainte-Claire Deville, and is under the control of the Governor-General. It contains 36 stations of all classes, some of which are in the Sahara. The observers are mostly volunteers, those in the far south being missionaries. The instruments, generally, are of the same patterns as those at Montsouris Observatory. Monthly *résumés* of the observations, including some stations in Tunis and Morocco, are published, together with a table of the daily rainfall. A telegraphic weather service has also been established for the coast stations, under the charge of Captain H. Brocard. This last service promises to be of special importance in connection with the proposed system for the Spanish coast. A large part of the storms which approach Europe from the Atlantic in the latitude of Portugal, escape notice at Paris, and can only be signalled thence when they have arrived in the Gulf of Lyons. It is also proposed to make the station in Senegal more permanent, where observations were made for some years by Dr. Borius.

PUY-DE-DÔME OBSERVATORY.

This observatory (altitude 4,813 feet) was completed and inaugurated in the autumn of 1876, but the instruments were not erected until a somewhat later period. The establishment of this Observatory is due to the exertions of M. Alluard, Professor of Physics at Clermont-Ferrand, who submitted a plan to the Minister of Public Instruction early in 1869, and M. Faye received directions to examine and report thereon, in consequence of which the sum of £4,000 was given by the Government and the local authorities for the establishment of the Observatory. In the present state of Meteorology, this Observatory is of great importance, as a knowledge of the physics of the upper strata of the atmosphere is indispensable,—and neither balloon ascents, owing to their ephemeral character, nor mountain-pass stations, owing to various local causes of disturbance, have hitherto helped us very much. In 1877 the instruments were only those of a station of the second order, and the observations are carried on under considerable difficulties,—the mean temperature resembling that of Christiania. The Observatory of *Rabanesse*, which lies in the plain near Clermont-Ferrand, is 3,609 feet lower, and a little over 6 miles distant as the crow flies, is in telegraphic communication with the Puy-de-Dôme. At Rabanesse eye observations are taken at the same times as at the mountain Observatory, and it receives from it two weather telegrams daily. M. Alluard has published a few fragmentary papers, but the corresponding observations of the two observatories are, we believe, not yet published.

Observatories have also been established—or are in course of

establishment—at the following places, in connection with the Central Office :—*Cluny*, *St. Maur* (station improved), *Mont-Ventoux* (7,663 feet), *Nancy*, *Pic-du-Midi* (7,763 feet), *Perpignan*, *Bordeaux*, and *Besançon*. The observations from the high-level stations at the *Puy de Dôme* and the *Pic du Midi* are telegraphed to Paris daily, and inserted iu the "*Bulletin*."

The following separate meteorological organizations also deserve special mention :—(1). The Hydrological Service of the Seine, which has published tidal and rainfall observations since 1854. Since 1872 similar observations have been made all over France ; the system is divided into 12 regions, numbering upwards of 1,100 stations. (2). The Hydrometrical Commission of Lyons (established in 1843), which publishes a report yearly ; in 1876 its stations numbered 29. (3). Researches in the domain of Ocean Meteorology at the *Dépôt des Cartes et Plans*, especially Lt. Brault's charts of the Atlantic. (4). Observations on Underground Temperature in the *Jardin des Plantes*, by M. Becquerel. (5). The Toulouse observations, 1839-62. (6). The *Dijon* observations, published in separate sheets for a number of years. (7). *St. Martin-de-Hinx* (Landes), where observations have been published since 1864.—J. S. HARDING.

SCHWACKHÖFER'S HYGROMETER.

IN the recently-issued report of the Meteorological Council, Mr. F. N. Shaw gives a summary of the instruments he is using in the investigation he is now conducting on Hygrometry and Hygrometers, on behalf of the Council.

In his memoir he states that he takes as his standard of reference the instrument designed by Prof. Schwackhöfer of Vienna, and as this hygrometer is not well known to English observers, we have made a brief extract of a notice respecting it which appeared in the *Zeitschrift für Meteorologie* for 1878.

After stating the great uncertainty which attaches to the various hygrometers now in use, due to causes beyond the control of the observer, Prof. Schwackhöfer concludes that the only correct determination of the amount of aqueous vapour suspended in the atmosphere is that of directly estimating it by chemical methods.

Of these methods there are two : analysis by weight, and analysis by volume. Hitherto the first has been the only plan employed, and to prosecute it satisfactorily not only is a heavy tax put upon the time and abilities of the observer, but the result obtained usually gives but an average for a lengthened period of time, not the humidity at any given moment. The volumetric method is free from these and other objections, and may be worked with a comparatively simple apparatus, kept ready to hand, and capable of giving the desired result with accuracy in a few minutes.

As to the degree of delicacy required, it may be remarked that as $0{\cdot}1^{mm.}$ (0·039 in.) of vapour tension represents about 0·013 per

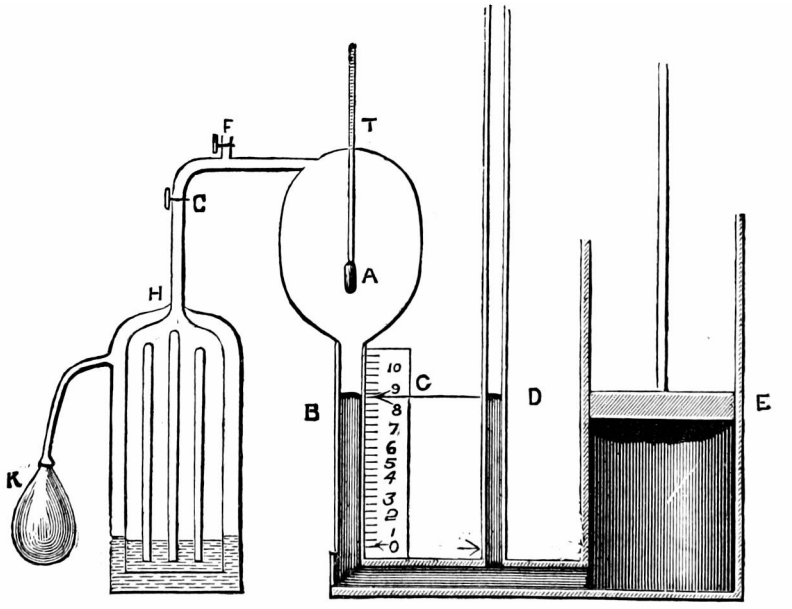
cent. of the volume of aqueous vapour in the air, the apparatus should indicate with certainty the change of one-hundredth per cent. or one-ten-thousandth part in the volume of air measured.

Although Schwackhöfer first constructed his instrument for the particular purpose of determining the humidity of the air at different levels in forests, and comparing it with air at similar heights in the open country, yet he considers that it may equally well be employed in place of ordinary pschycrometers for daily observations at meteorological stations, since it is always ready for immediate use, and without much calculation will give the humidity, the operation occupying about ten minutes or a quarter of an hour.

The principle of the instrument may be briefly stated to be as follows:—a volume of air is enclosed in a glass vessel and its temperature accurately determined; it is then forced into a second vessel, where by intimate contact with concentrated sulphuric acid, it is deprived of all its water. The dried air is then again transferred to the first vessel, and the amount which it has lost in volume is measured. If the temperature and pressure be the same as it was before drying a short calculation based on the quantity determined, gives the vapour tension at the time of the experiment.

In the case of fog, the air is heated slightly before it is passed into the apparatus, so that the watery vesicles may be converted into vapour.

The diagram will afford an idea of the construction of the instrument.



A is the receiver to contain the air to be experimented upon; T being the thermometer to measure its temperature. H is the drying vessel, exposing a large glass surface wetted with concentrated

sulphuric acid. E is the mercurial pump to force the air into and out of the receiver A, and D is a pressure gauge to indicate the pressure of the air in A. K is an indiarubber ball by compressing which the sulphuric acid is caused to flow over the inner surface of the drying chamber.

In order to make an observation, the plunger in E is depressed to nearly its full extent, and the tap F being open, all the air is expelled, and the mercury caused to fill A as far as F, the column in the pressure gauge D of course rising to the same level. On raising E the mercury falls, and the air follows it until the surface of the column in both C and D is at the zero of the scale. F is then closed, and the temperature of A read off on thermometer T. Next G is opened, and the plunger E being a second time forced down, the air is expelled from A and driven into G, where, coming into contact with the acid-wetted surface, its moisture is speedily absorbed. Finally E is again raised withdrawing the mercury from A, into which the dried air then passes, and when the pressure gauge D has regained its old level at the zero of the scale, the level in C will be found to stand above it by an amount which, when measured on the scale, represents the diminution of volume of the air in A by the quantity of aqeuous vapour withdrawn from it, and retained by the acid in B. The temperature at the conclusion of the experiment is again observed by the thermometer D.

In order to ensure the complete removal of all the aqueous vapour from the air, it is desirable when it is very damp to repeat the operation of forcing it into the drying chamber two or three times, until it is found that it does not diminish in volume by the process.

Schwackhöfer shows by a small calculation that the acid is not materially deteriorated as regards its drying properties by many thousands of operations.

As, however, the receiver A, and its divided tube B, form virtually an air thermometer, it becomes of vital importance to maintain the temperature of the air as nearly as possible constant during the operation, and to determine it with the greatest possible accuracy at least to 0°·03 C (0°·05 F.). With the view of maintaining this constancy of temperature, A is surrounded with a large jacket apparatus, filled with glycerine, which is not represented in the drawing.

The capacity of both receiver A and its tube B, which of course in the apparatus is much smaller relatively than that shown in the figure, must be accurately determined beforehand, and the values of the divisions on the scale C found by calibration, and expressed in terms of the volume of A.

For the complete demonstration of the theory of the instrument and the formulæ for the reduction of observations made by it, we must refer the reader to Schwackhöfer's original paper in the *Zeitschrift*, Band xiii., s. 241.

It only remains to state that the cost of the Hygrometer at Vienna is 160 florins, or about £14; with the heating apparatus for evaporating fog it is raised to about £18. G. M. WHIPPLE.

THE SNOW STORMS OF JANUARY 17TH TO 21ST.

(Continued from page 24.)

MIDLAND RAILWAY,
General Manager's Office,
Derby, February 14th, 1881.

DEAR SIR,—In accordance with the request contained in your letter of the 3rd inst., I have much pleasure in enclosing you the particulars you require respecting the late snow storms, so far as they affected the districts served by the Midland Railway Company.

I need hardly say that the information has been compiled at considerable trouble, and if it is printed in a handy form, I should like to have a copy if you have one to spare.—I am, yours faithfully,

G. J. Symons, Esq. JOHN NOBLE.

PLACE.	Average depth of snow. in.	Depth of snow in drifts. ft.	Extent to which Traffic was interfered with.
JAN. 18th :—			
Newstead and Sutton (between Nottingham and Mansfield)	4 to 7	4 to 6	Traffic interfered with at Sutton for about an hour on evening of 18th. Up line blocked about 7 hours on morning of 19th, owing to a coal train getting stuck fast in the snow.
Syston, near Leicester...	5 or 6	4 to 6	Several goods trains delayed during night of 18th.
Between Leicester and Rugby, and between Leicester and Market Harbro'	6 to 8	5 to 8	Several passenger and goods trains delayed between these points during the night of the 18th, and on the morning of the 19th.
Between Huntingdon and Thrapstone	7 or 8	1 to 6	The line between these points was impassable from 11 p.m. 18th, until the evening of the 20th, and traffic entirely suspended.
Between Wellingboro' and Sharnbrook	7 or 8	4½ to 5	The up line was blocked for a short time between these stations during night of the 18th, and the traffic was delayed.
Bedford and Northampton Branch, and Bedford and Hitchin Branch	—	2 to 5	These branches were completely blocked with snow from the evening of the 18th to the evening of 20th, and traffic entirely stopped.
Between Leagrave and Luton	—	2 to 3	Goods traffic delayed for several hours on the morning of the 19th.
In neighbourhood of London	about 9	4 to 6	No serious obstruction was caused to the traffic.
Between Burton and Leicester	5 or 6	1 to 3	Several goods and passenger trains considerably delayed during the night of the 18th, and on the 19th.
JAN. 19th.			
In neighbourhord of Ashwell, Whissendine, Saxby, & Melton (between Peterboro' and Leicester)	about 9	4 to 6	All traffic was more or less delayed during the whole of the 19th, owing to the drifts between these points.
Between Barnt Green and Evesham	about 6	3 to 4	The line between these points was partially blocked by snow during the 19th, and traffic was considerably interfered with.

PLACE.	Average depth of snow. in.	Depth of snow in drifts. ft.	Extent to which Traffic was interfered with.
Between Ashchurch and Beckford	do.	about 3	The up line was blocked by snow between these points from the morning of the 19th to the evening of the 20th.
Between Ashchurch and Cleeve	do.	6 to 7	The line was entirely blocked from about midnight of 18th to 10 a.m. on the 19th, and partially blocked until the evening of that day. Traffic considerably delayed.
Stonehouse and Nailsworth Branch	6 to 8	4 to 5	Goods traffic stopped on branch on this day.
Nate and Thornbury Branch	about 12	6 to 20	Traffic stopped, except for a few hours in the morning.
Mangotsfield, near Bristol	about2ft	4 to 9	Line partially blocked for several hours, and traffic considerably interfered with.
Between Hereford and Brecon, and between Brecon and Swansea.	about 8	6 to 15	The line between Hereford and Brecon blocked nearly the whole of the 19th, and the line between Brecon and Ynisygenio Junction from the evening of the 18th to the morning of the 24th, and all traffic stopped.

SOUTH EASTERN RAILWAY,

General Manager's Office,
London Bridge Station, S.E., 18th February, 1881.

SIR,—In compliance with your request of the 3rd inst., asking for information respecting obstruction of this railway, &c., by snow, on the 18th ult., I beg to enclose herewith a statement giving the particulars I have been able to collect, and which I trust may be of service to you.

I would explain that, not anticipating any possibility of such information being required, no exact account was taken at the time, and, in consequence, there has been some difficulty in getting the facts together; and this, moreover, is the explanation of my having failed to send you the enclosed sooner.—Yours faithfully,

MYLES FENTON,
General Manager.

G. J. Symons, Esq.

SOUTH-EASTERN RAILWAY.

One line was blocked between Erith and Dartford from the afternoon of the 18th until late on the 19th.

The down loop line was blocked near Dartford from 7.50 p.m. on the 18th until late at night, and the same line was also blocked at Pope Street for about the same period.

The down line between Plumstead and Abbey Wood was blocked from 8 p.m. on the 18th until the next morning.

The Mid-Kent lines, both up and down, were blocked between

Catford Bridge and Lower Sydenham from about 2 p.m. on the 18th till 9 p.m. on the 19th.

The Whitstable Branch (which is a single line) was blocked from about 8 p.m. on the 18th until 12.30 on the 19th.

On the Ashford and Hastings Branch, two or three sections were blocked on one line only from 2 p.m. on the 18th to 7 p.m. on the 19th.

Between Wokingham and Earley both lines were blocked for about four hours on the 18th.

Between Wye and Chilham there was a block on the down line from 10 p.m. on the 18th until midnight on the 19th.

The down line on the Margate Branch was blocked from the morning of the 18th until 10 p.m. on the 19th.

The Sevenoaks line was kept open for traffic, but considerable delay occurred.

The up line between Blackwater and Farnborough was blocked for some few hours from about 5.37 a.m. on the 19th.

The Caterham Branch (which is a single line) was blocked for about three hours only on the 18th.

With the exception of the single lines, and the block on both lines of the Mid-Kent section, the traffic was kept going, although, of course, with some amount of delay, &c.

Particulars in connection with the Snow Storm on the 18th January, 1881.

Locality.	Average depth of drifts.	Remarks.
Charing Cross to Paddockwood viâ North Kent Line—		
Charing Cross to Erith	12 in.	Down line between Plumstead and Abbey Wood blocked 8 p.m. till next morning(19th).
Erith to Dartford.....	4 to 12 ft.	In one cutting, ¼ mile long, 12 to 14 ft. deep. Traffic suspended from afternoon of 18th till next day.
Dartford Junction	5 ft.	250 yards.
Dartford to Gravesend	5 ft.	In various cuttings, ¼ mile long.
Strood to Mainstone	4 ft.	Short drifts.
Maidstone to Paddockwood.	...	Average fall about 15 inches.
North Kent Loop Line—		
Lee to Dartford	...	Line blocked at Pope Street on night of 18th inst.
,, ,, ...	3 to 4 ft.	Short drifts. Down line near Dartford blocked 7.50 p.m. till next morning.
Mid Kent Line—		
Lewisham Junct. to Catford Bridge	12 in.	
Catford Bridge to Lower Sydenham	3 to 6 ft.	In cutting, ½-mile long, train blocked in. Traffic suspended from about 2 p.m. on 18th till 9 p.m. on 19th.
On various parts of the Line below Lower Sydenham	2 to 3 ft.	

Locality.	Average depth of drifts.	Remarks.
Main Line to Tonbridge viâ Sevenoaks—		
Grove Park	3 ft.	30 yards long. Considerable delay to traffic.
Halstead	18 in.	Considerable delay to traffic.
Chelsfield	13 to 14 ft.	50 yards long. Considerable delay to traffic.
Caterham Branch (single line)	...	Blocked about 3 hours on 18th. Train ran into drift and partially left the metals.
Reading Branch—		
Farnboro' to Blackwater	2 ft.	Up line blocked for some hours on 19th.
Wokingham to Earley	1 ft. 6 in.	Line blocked about 4 hours on 18th.
Tunbridge Wells and Hastings Branch—		
Tunbridge Wells to Hastings	...	Average fall about 15 inches.
,, Goods Station	3 ft.	About ¼-mile.
Wadhurst	2 to 3 ft.	200 yards.
Ticehurst Road	3 ft.	200 yards.
Etchingham	3 ft.	200 yards.
Main Line — Tonbridge to Dover—		
Marden (Cutting and Station Yard)	1 ft.	800 yards.
Staplehurst	2 ft.	100 yards.
Headcorn	9in. to 1ft.3in.	470 yards.
Pluckley	1 ft.	250 yards.
Ashford to Smeeth	1in. to 1ft.3in.	900 yards.
Westenhanger	3 ft.	170 yards. Siding blocked.
Westenhanger to Shorncliffe.	1 to 1 ft. 6 in.	Various drifts, about 390 yards.
Marden to Dover	...	Average fall, 5 or 6 inches.
Ramsgate and Margate Branch		
Ashford to Wye	2 to 5 ft.	Up line blocked 10 p.m. on 18th to 9 a.m. on 19th.
Wye to Chilham	3 ft.	Block on down line 10 p.m. on 18th till midnight on 19th.
Grove Ferry to Minster	2 to 3 ft.	Down line blocked from morning of 18th till 10 p.m. on 19th.
Margate Branch	3 to 7 ft.	Up line blocked 11.30 a.m. on 18th till 5 p.m. on 22nd.
Ashford to Ramsgate and Margate	...	Average fall, 5 inches.
Whitstable Branch (single line)	3 to 4 ft.	Line blocked from 1 p.m. on 18th until noon on 19th. Obstructed again 7 a.m. to noon on 20th.
Ashford and Hastings Branch	4 ft.	Traffic suspended from 2 p.m. on 18th to 7 p.m. on 19th. Average fall, 4 inches.

FEBRUARY, 1881.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	3·09	+ 1·45	·76	20	16	52·7	3	26·7	7	9	17
II.		Maidstone (Hunton Court)	1·79	+ ·17	·48	23	17	...	...	...	...	...	...
,,		Strathfield Turgiss	2·18	+ ·43	·55	7	11	53·3	3	23·4	7, 28	12	19
III.		Hitchin	2·91	+ 1·31	·60	20	22	50·0	3	21·0	28	18	...
,,		Banbury	2·95	+ 1·11	·66	7	18	50·0	3	23·0	7	16	...
IV.		Bury St. Edmunds (Culford)	2·83	+ 1·06	·79	9	18	49·0	3, 4	23·0	6	13	...
,,		Norwich (Cossey)	3·45	+ 1·70	·72	9	21	50·0	4, 9	22·8	13	15	16
V.		Bridport	5·46	...	1·41	14	12	50·0	10	23·0	28	13	...
,,		Barnstaple	3·83	+ ·64	1·31	9	15	54·0	3*	28·0	26†	...	...
,,		Bodmin	7·29	+ 2·42	1·88	13	18	51·0	14	27·0	28	7	11
VI.		Cirencester	5·03	+ 2·39	·99	14	15	...	...	...	...	...	...
,,		Church Stretton (Wcolstaston	4·11	+ 1·60	1·15	9	20	49·5	3	?21·5	28	..	...
,,		Tenbury (Orleton)	3·46	+ ·99	·63	9	19	52·0	3	22·5	7	12	14
VII.		Leicester (Town Museum)	3·63	...	·67	7	18	51·0	3	11·3	13	14	18
,,		Boston	3·70	+ 1·92	·85	21	16	...	...	...	...	...	...
,,		Grimsby (Killingholme)	2·55	+ ·75	·54	14	23	51·0	4	29·0	2, 7	10	...
,,		Mansfield	4·44	+ 2·27	·83	7	19	49·6	4	21·8	24	15	20
VIII.		Manchester (Ardwick)	5·52	+ 3·33	1·17	15	18	55·0	4	21·0	7	15	...
IX.		Skipton (Arncliffe)	7·29	+ 2·65	1·69	7	16	47·0	3	15·0	28	14	...
,,		Malton	...	...	...	...	...	...	...	...	..	...	...
X.		North Shields	3·81	+ 1·97	·74	26	22	47·0	4	23·7	7	15	18
,,		Borrowdale (Seathwaite)	10·27	— 1·18	1·49	3	16	...	...	...	...	..	...
XI.	WALES.	Cardiff (Ely)	5·12	+ 1·46	1·25	9	14	...	...	...	...	...	...
,,		Haverfordwest	5·04	+ ·59	·67	9, 13	16	50·5	2, 3	21·0	24	10	13
,,		Aberystwith Goginan	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	3·05	+ ·76	·68	7	15	53·6	18	28·0	25	5	...
XII.		Cargen	4·32	+ ·51	·89	13	11	49·0	3, 4	26·0	28	10	...
,,		Hawick (Silverbut Hall)	2·62	— ·27	·52	7	13	...	...	..	...	...	...
XIV.		Douglas Castle (Newmains)	3·77	+ ·60	·62	9	17	...	...	...	...	...	...
XV.		Loch Long (Arddaroch)	...	...	...	...	...	...	...	...	...	...	...
,,		Kilmory	4·92	+ ·53	1·23	13	15	...	...	19·0	12	...	...
,,		Mull (Quinish)	4·23	...	·83	3	15	..	...	...	...	...	...
XVI.		Loch Leven	5·60	+ 2·64	1·90	4	9	...	...	...	...	...	...
,,		Arbroath	3·87	+ 1·71	·75	3	13	47·0	4	23·0	28	15	...
XVII.		Braemar	2·32	...	·55	3	14	42·2	3	27·0	12	25	26
,,		Aberdeen	4·96	...	·90	10	22	44·0	4	21·0	6	14	...
XVIII		Portree	4·87	— ·31	·89	7	19	...	...	...	...	...	...
,,		Inverness (Culloden)	1·85	+ ·80	...	...	..	45·0	16	21·0	12‡	17	28
XIX.		Dunrobin	3·31	...	1·40	3	15	45·5	1	22·8	12	17	...
,,		Sandwick	5·30	+ 2·75	1·66	7	17	43·8	1	26·0	12	10	17
XX.	IRELAND.	Cork (Blackrock)	5·95	+ 1·36	·86	6	16	55·0	13	20·0	28	9	...
,,		Darrynane Abbey	...	...	...	...	...	...	...	...	...	...	...
,,		Waterford	4·40	...	1·00	6	9	...	...	...	..	...	...
,,		Killaloe	5·05	...	1·79	9	15	53·0	14	25·0	24	9	...
XXI.		Portarlington	3·69	+ 1·48	1·10	9	18	53·0	7	26 0	27	8	...
,,		Monkstown	2·36	...	·60	9	13	57·0	7	28·0	1, 6	..	...
XXII.		Galway	3·55	...	·58	7	12	52·0	8	25·0	28	5	...
XXIII		Wahingstown	3·06	+ ·81	·70	9	20	51·0	3, 7	23·0	27	13	16
,,		Londonderry	3·85	...	·64	7	19	50·0	3, 7	31·0	1§	5	16
..		Edenfel (Omagh)	2·73	+ ·45	·46	3	19	49·0	7	20·0	28	15	...

* And 4, 17. † And 27. ‡ And 28. § And 6, 12.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—Clay lands sodden and water-logged at the beginning of the month; genial weather much wanted at the close. First wild primrose gathered on 2nd; first daisy on 25th.

HITCHEN.—S on eight days; L on 7th, 8th, and 9th.

BANBURY.—S on eight days.

CULFORD.—The month throughout was unsettled and very cold, with but little sunshine.

COSSEY.—A wet, cold month; floods prevalent.

BODMIN.—Mean temp., 41°·8; temp. at the end of the month lower than has ever been recorded before.

CIRENCESTER.—Wind variable, but a full share from the E. Several heavy falls of R.

ORLETON.—A very cold and gloomy month, with much S and R, and severe frost at intervals. Sky generally cloudy, and the sun rarely visible. Violent winds on 7th and 11th; high floods on the Teme on the 8th and 11th, and very great flood on Severn on 12th.

KILLINGHOLME —Very cold and wet; scarcely any sunshine, and not more than two pleasant days.

MANSFIELD.—S on 11 days, and a good deal of frost.

NORTH SHIELDS.—S on 15 days; very cloudy and much R.

WALES.

HAVERFORDWEST.—The first 17 days very wet, with heavy floods; fine solar halo on the 6th; exceedingly stormy from the 7th to the 11th. T and L, with heavy gale and R on the 8th. On the 20th the air completely changed, the wind, which had generally blown from S.W. or N.W., gradually drew to E. and N.E., and fine clear weather prevailed for the last 8 days, with sharp frosts, the mean temp. of that period being only 32°·8. Mean temp. of the month, 39°·2. Precelly range white with S, from end to end, on 27th.

LLANDUDNO.—Month relatively warmer than January, but still more than $2\frac{1}{2}°$ below the average. February is usually the driest month of the year, but in this the rainfall was excessive. The general character of the month was showery, and S or H fell on 5 days. Though there were 7 hours of bright sunshine recorded, the atmosphere was not so clear as usual, but was sometimes hazy, approaching even to fog. Polar winds prevailed on 16 days, and tropical on 12. Force variable, occasionally rising to above half a gale.

SCOTLAND.

CARGEN.—A dull, cloudy month, with low temp. and little sunshine. Mean temp., 36°·6, 3°·3 below the average.

HAWICK.—A very frosty February, garden and farm work consequently much in arrear. All vegetation in a very bad state.

NEWMAINS.—S on six days.

BRAEMAR.—A very cold month; hill and dale, road and paths still covered with S.

ABERDEEN.—Winds very variable, westerly at first, shifting to E., S.E., and finally to N.E. Raw weather was the consequence, with frequent heavy showers of S, sleet, H and R. Rainfall above the average by about 2 inches. Aurora seen on night of 27th.

PORTREE.—A cold month; sheep suffering much from the continuous hard frost. Provender for cattle getting very scarce.

CULLODEN.—The month was remarkable for the steady continuance of frost.

SANDWICK.—Very cold, wet, and stormy. Temp. 3°·4 below the mean. Gales of 50 miles an hour occurred on the 4th and 7th. S fell on the 4th, covering the ground, and became deeper daily till the 13th, when a thaw set in. Another fall occurred on the 27th and 28th.

IRELAND.

BLACKROCK.—A dull, wet, and stormy month. Splendid display of auroral lights on 1st.

KILLALOE.—Strong wind from S.W. on 7th, increasing in force, with heavy R, until late on 10th. Some severe frost towards the end of the month.

LONDONDERRY.—The wettest February for several years; wind variable.

SUPPLEMENTARY TABLE OF RAINFALL IN FEB., 1881.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	3·26	XI.	Corwen, Rhug	4·88
,,	Margate, Acol	1·28	,,	Port Madoc	4·41
,,	Littlehampton	3·24	,,	Douglas.....	7·37
,,	St. Leonards	1·91	XII.	Carsphairn	5·30
,,	Hailsham	2·86	,,	Melrose, Abbey Gate...	3·13
,,	I. of W., St. Lawrence.	4·06	XIV.	Glasgow, Queen's Park.	3·66
,,	Alton, Ashdell.....	2·83	XV.	Islay, Gruinart School..	4·89
III.	Great Missenden.....	3·45	XVI.	Cupar, Kembach.....	4·34
,,	Winslow, Addington ...	2·54	,,	Aberfeldy H.R.S.	...
,,	Oxford, Magdalen Col...	2·68	,,	Dalnaspidal	3·47
,,	Northampton	2·76	XVII.	Tomintoul.....	...
,,	Cambridge, Merton Vil.	2·34	,,	Keith H.R.S.	2·20
IV.	Harlow, Sheering	3·38	XVIII.	Forres H.R.S.	2·03
,,	Diss	2·83	,,	Strome Ferry H.R.S....	2·94
,,	Swaffham	3·28	,,	Lochbroom	2·32
,,	Hindringham	3·24	,,	Tain, Springfield.....	2·87
V.	Salisbury, Alderbury...	3·63	,,	Loch Shiel, Glenfinnan.	5·62
,,	Calne, Compton Bassett	3·63	XIX.	Lairg H.R.S.	2·00
,,	Beaminster Vicarage ...	7·26	,,	Altnabreac H.R.S.	...
,,	Ashburton, Holne Vic..	10·15	,,	Watten H.R.S.	3·16
,,	Langtree Wick	4·39	XX.	Fermoy, Glenville	5·69
,,	Lynmouth, Glenthorne.	5·41	,,	Tralee, Castlemorris ...	3·85
,,	St. Austell, Cosgarne...	5·71	,,	Cahir, Tubrid	4·80
,,	Taunton	...	,,	Tipperary, Henry St....	4·28
VI.	Bristol, Ashleydown ...	3·84	,,	Newcastle West	3·12
,,	Ross	3·08	,,	Kilrush	2·99
,,	Wem, Sansaw Hall.....	3·37	,,	Corofin	4·02
,,	Cheadle, The Heath Ho.	5·39	XXI.	Kilkenny, Butler House	...
,,	Bickenhill Vicarage ...	3·99	,,	Carlow, Browne's Hill..	3·66
VII.	Melton Mowbray	3·43	,,	Kilsallaghan.....	...
,,	Horncastle, Bucknall ...	3·30	,,	Navan, Balrath	3·36
VIII.	Walton-on-the-Hill.....	4·11	,,	Athlone, Twyford	3·25
,,	Broughton-in-Furness ..	6·44	,,	Mullingar, Belvedere...	4·44
IX.	Wakefield, Stanley Vic.	3·26	XXII.	Ballinasloe	..
,,	Ripon, Mickley	4·84	,,	Clifden, Kylemore	7·04
,,	Scarborough.....	3·13	,,	Crossmolina, Enniscoe..	4·74
X.	Mickleton.....	3·91	,,	Carrick-on-Shannon ...	4·18
,,	Haltwhistle, Unthank..	3·28	XXIII.	Dowra	3·80
,,	Shap, Copy Hill	5·50	,,	Rockcorry.....	4·28
XI.	Llanfrechfa Grange	7·08	,,	Warrenpoint	5·06
,,	Llandovery	4·34	,,	Newtownards	4·11
,,	Solva	2·68	,,	Carnlough.....	4·26
,,	Castle Malgwyn	4·82	,,	Bushmills	4·25
,,	Rhayader, Nantgwillt..	8·27	,,	Buncrana	3·79
,,	Carno, Tybritle	7·27			